

1 Introduction

This *Manual* explains the California energy efficiency standards for low-rise residential buildings (*Standard*). The *Manual* is organized in eight chapters and supported by several appendices. This chapter is an introduction and discusses:

- Purpose and Organization of this Manual
- Summary of Recent Changes
- Background
- Introduction to the Residential Standards
- Code Decisions: Case Studies
- Where To Get Help

More information is available at www.energy.ca.gov/title24.

1.1 Purpose and Organization of this Manual

The purpose of this *Manual* is to explain clearly how to comply with and enforce the California energy efficiency standards for residential buildings. The *Manual* is written as both a reference and an instructional guide. It can be used by architects, builders, building owners, designers, energy consultants, enforcement agency personnel, engineers, mechanical contractors and others directly or indirectly involved in the design and construction of residential buildings. “Section” refers to a section in this *Manual* while sections from the *Standard* are represented by “§”.

Portions of the *Manual* focus on improving comfort through construction quality. For instance, Chapter 2 includes diagrams and guidelines for HVAC systems and ducts, including graphic representations of well-constructed duct systems. Chapter 4 includes diagnostic testing procedures for duct leakage, envelope infiltration, and procedures for HVAC system design and installation.

The Chapters

The *Manual* is organized into eight chapters, each of which covers an important topic, or set of topics, regarding energy compliance and energy conservation in residential buildings. There are also several appendices and an extensive glossary.

- *Chapter 1 Introduction* – serves as an overview of the *Standards*. It explains how the *Standards* apply to various building occupancies and highlights key aspects of compliance.
- *Chapter 2 Mandatory Measures* – discusses the mandatory requirements relating to insulation levels, infiltration controls, HVAC and plumbing systems, lighting and appliance features.
- *Chapter 3 Prescriptive Packages* – presents a detailed explanation of how to comply using the prescriptive method; an example of prescriptive compliance documentation; and a listing of the prescriptive package requirements for all 16 climate zones.









- *Chapter 4 Compliance Through Quality Construction* – details the compliance process using low leakage ducts, reduced building envelope infiltration, and tuned HVAC equipment. These compliance options require installer certification, field verification, and diagnostic testing by a certified HERS rater.
- *Chapter 5 Computer Method* – details the compliance process using Approved Computer Methods; outlines computer modeling guidelines and restricted inputs; and illustrates computer compliance documentation.
- *Chapter 6 Water Heating* – covers energy use, calculations, and compliance documentation for water heating.
- *Chapter 7 Additions and Alterations* – explains compliance for additions and alterations using the prescriptive and the performance approaches.
- *Chapter 8 Special Compliance Topics* – addresses the application of the *Standards* for multi-family buildings, mixed occupancy buildings, subdivision master plans, wood heat, log homes, solar energy systems, zonal control, and hydronic space heating.

The *Manual* is supported by 12 appendices as described below:

- *Appendix A* – Compliance Forms
- *Appendix B* – Materials Reference
- *Appendix C* – California Design Location Data
- *Appendix D* – California Climate Zone Descriptions
- *Appendix E* – List of Publications
- *Appendix F* – List of Approved Computer Programs
- *Appendix G* – Glossary and Explanation of Key Terms
- *Appendix H* – Construction Assemblies
- *Appendix I* – Framing Calculations / Tables / Forms
- *Appendix J* – Standard Procedure for Determining the Seasonal Energy Efficiencies of Residential Air Distribution Systems
- *Appendix K* – Procedures for HVAC System Design and Installation
- *Appendix L* – Procedures for Determining Required Refrigerant Charge and Adequate Airflow for Split System Space Cooling Systems without Thermostatic Expansion Valves

Graphic Icons are used throughout this *Manual* to provide a key to the type of information that is presented and whom it is intended for. The following table describes these icons.

Table 1-1 – Icons
Used in Document

	Relevant language (in <i>italics</i>) from the 2001 <i>Energy Efficiency Standards</i>		Examples and newsletter excerpts
	Explanations and other direction for the energy consultant and plan checker		General information and concepts
	Explanations and other direction for the builder		Information about how products or materials use and conserve energy
	Explanations and other direction for the inspector		Tools for improving the quality of construction to increase comfort and customer satisfaction and to reduce callbacks and liability

1.2 Summary of Recent Changes

This section describes recent events in California and how the *Standards* have changed in response to these events.

1.2.1 California's Energy Crisis and Assembly Bill 970

In the summer of 2000, California experienced rolling blackouts in the San Francisco Bay area, and electricity bills in San Diego that went up by 200-300%. These events signaled the beginning of an energy crisis that continued into 2001 with rolling blackouts becoming a common occurrence throughout the state. High energy prices depleted the state surplus and caused California's largest utility to file Chapter 11 bankruptcy. At the date of this writing, the State's electrical system continues to be vulnerable to increasing electricity demand, generation supply shortages, transmission constraints, and extremely high wholesale electricity costs caused by an unstable market.

Assembly Bill 970

At the close of the 2000 legislative session, the Legislature responded to the crisis by passing AB 970, an urgency statute that became effective when the Governor signed it on September 6, 2000. The statute, known as the California Energy and Reliability Act of 2000, found that there has been significant growth in the demand for electricity and that new power plant construction and energy conservation have seriously lagged. The act provides a balanced response by providing significant investment in conservation and demand-side management programs. In particular, AB 970 added Section 25553 to the Warren Alquist Act, as follows:

Notwithstanding any other provision of law, on or before 120 days after the effective date of this section or on the earliest feasible date thereafter, the Commission shall . . . (b) Adopt and implement updated and cost-effective standards pursuant to Section 25402 to ensure the maximum feasible reductions in wasteful, uneconomic, inefficient, or unnecessary consumption of electricity.

In response to AB 970, the Commission conducted an emergency rulemaking to develop amendments to the *Standards*, which were adopted by the Commission on January 3, 2001 (119 days after AB 970 was signed by the Governor). The AB 970 amendments to the *Standards* focused on reducing peak electricity consumption and demand in the shortest time possible. For consideration in the AB 970 rulemaking, measures had to have the following characteristics:

- Substantial information was already available regarding their benefits and costs;
- Specifications and eligibility criteria could be developed quickly within the time the Legislature allotted; and
- The industry would be able to incorporate the changes on an emergency basis without disruption to construction practice.

The Worsening Situation

Since AB 970 was passed by the Legislature and the 2001 *Standards* were adopted, the reliability of California's electricity system has continued to deteriorate. In his January 2001 State of the State message, the Governor placed highest priority on actions to address what he termed the electricity nightmare. He included the following points in his message:

"Electricity is a basic necessity of life. It is the very fuel which powers our high-tech economy. A dysfunctional energy market is threatening to disrupt people's lives and damage our economy. It has resulted in skyrocketing prices and an unreliable supply of electricity, causing the average price per megawatt hour to increase by 900%, compared to last year. By reducing peak demand, we can reduce the price; avoid shortages; and lower energy bills."

In January 2001, power plant outages led to inadequate electricity supplies in California, causing multiple Stage 3 alerts and rolling blackouts in Northern California. The cost of natural gas also has rapidly increased during this period.

The Commission is continuing to update the *Standards* to respond to the energy crisis. Additional enhancements and improvements are being planned for the next update, to be adopted in about 2003 and take effect in 2005.

1.2.2 Assembly Bill 970 Changes

This section summarizes the 2001 changes to the low-rise residential standards that were adopted as part of the AB 970 emergency rulemaking. The changes include additions to the base prescriptive requirements for: duct sealing; air conditioner calibration and testing; radiant barriers in attics; and improved fenestration. Most of these new requirements only apply in hot climates where air conditioning energy contributes significantly to California's summer electricity peak. In addition to the fundamental changes in the base prescriptive requirements, additional compliance options were added for cool roofs and an alternative package was provided to enable compliance with the *Standards* without the need for verification or diagnostic testing by a HERS rater.

Changes to Alternative Component Package D

Alternative Component Package D contains the basic prescriptive requirements for low-rise residential buildings and several significant changes were made, including new requirements for radiant barriers, duct sealing and air conditioner efficiency improvements. In addition, the fenestration criteria were made more stringent in many climates. With the exception of duct sealing, the new requirements apply only to the hotter California climates, which contribute most to the summer electricity demand. The changes are summarized in the following table for each of the climates. More detail is provided in the bullets that follow and later in the *Manual*.

**Table 1-2 –
Summary of
Changes to
Package D**

Climate Zone	Radiant Barrier	Maximum Fenestration U-factor	Maximum Fenestration SHGC	Duct Sealing*	Charge and Airflow Testing or TXV*
1	--	--	--	Required	--
2	Required	0.65	0.40	Required	Required
3	--	--	--	Required	--
4	Required	0.75	0.40	Required	--
5	--	--	--	Required	--
6	--	--	--	Required	--
7	--	0.75	0.40	Required	--
8	Required	0.75	0.40	Required	Required
9	Required	0.75	0.40	Required	Required
10	Required	0.65	0.40	Required	Required
11	Required	0.65	0.40	Required	Required
12	Required	0.65	0.40	Required	Required
13	Required	0.65	0.40	Required	Required
14	Required	0.65	0.40	Required	Required
15	Required	0.65	0.40	Required	Required
16	--	--	--	Required	--

-- means no change from current requirements

* Duct sealing, charge and airflow testing, and thermostatic expansion valve (TXV) require diagnostic testing and/or field verification by a certified HERS rater.

Other Package D requirements remain unchanged.

Radiant Barriers

Radiant barriers, which were previously a compliance option, are required in climate zones 2, 4, and 8 through 15. Radiant barriers are shiny metallic surfaces that are applied to the roof (and to end walls at attic conditions). The barrier reduces heat flow between the solar-heated roofing and the ceiling, thus lowering interior temperatures and temperatures in the attic or in enclosed rafter spaces between the roof and the ceiling. This reduces air conditioning energy, both because the cooling load is lower for the conditioned space and the air distribution ducts are more efficient because of the lower attic temperature. Qualifying radiant barriers must have an emittance of 0.05 or less and be certified by the Bureau of Home Furnishings. More details about the installation requirements for radiant barriers are presented in Section 3.4 under Prescriptive Packages.

Solar Heat Gain Coefficient

The *Standards* reduce solar heat gain through windows and skylights in climate zones 2, 4, and 7 through 15, again the climates where cooling loads and peak demand for electricity are the most significant. The required solar heat gain coefficient (SHGC) is reduced to 0.40 in these locations for all orientations. Previously, the 0.40 SHGC requirements only applied to limited climate zones and/or orientations. The new SHGC requirement will typically be achieved with "low solar, low emissivity" glass, also known as "spectrally selective" glass. Fenestration product performance for Prescriptive compliance in these climate zones must be documented using U-factor and SHGC data provided by the National Fenestration Rating Council (NFRC).

Diagnostic Testing of Air Distribution Ducts

Diagnostic testing of air distribution ducts is required in every climate zone as part of the AB 970 changes to Package D. All ducts must be tested, and sealed if necessary, so that the leakage is less than or equal to 6% of the fan volume, e.g. if the fan delivers 1,000 cfm, the leakage cannot exceed 60 cfm. Up to 30% of heating and cooling energy can be lost through poorly installed or poorly sealed ducts so this is very cost effective measure. Prior to the AB 970 changes, diagnostic testing of ducts was a compliance option; now it is a requirement. The testing must be performed by a certified HERS rater. The testing is

a prescriptive requirement, which can be avoided with the performance method. As an alternative to duct sealing and testing, builders can install higher efficiency HVAC equipment and higher performance glazing; the alternative requirements vary by climate zone. See Alternative to Package D below.

The mandatory duct construction requirements are changed to prohibit the use of building cavities as ducts. Also, cloth back rubber adhesive duct tape, if used, must be used in combination with mastic and drawbands. See more below on changes to mandatory measures.

***Refrigerant
Charge and Air
Flow
Measurement or
Thermostatic
Expansion Valves
(TXVs)***

For residential air conditioners to operate at optimum efficiency, the refrigerant charge and the airflow across the cooling coil must be carefully adjusted in the field at the time of installation. This is true for both air conditioners and heat pumps, when operating in a cooling mode. Improper charge and airflow can cause other problems as well. Excessive charge can cause premature compressor failure, while insufficient charge allows compressors to overheat. Very low airflow can result in icing of the coil and cause compressor failure. To help avoid these problems and provide for optimum energy performance, the AB 970 changes require one of two options. Either a technician must verify that the equipment has the correct airflow and refrigerant charge, or a thermostatic expansion valve (TXV) must be installed for the air conditioner. Either must be verified by a HERS rater. These requirements apply to split system air conditioners and heat pumps, but not to packaged air conditioners.

***Fenestration in
Additions and
Alterations***

Fenestration installed in residential alterations and additions of up to 100 ft² must meet the package D requirements for SHGC (0.40 in the hot climates) and the fenestration U-factor must be less than or equal to 0.75. These requirements apply when the prescriptive method of compliance is used. If fenestration is being repaired or replaced, but not in conjunction with a building alteration, it is exempt from the 0.75 U-factor and Package D SHGC requirements.

***Alternative to
Package D***

Package D requires that air distribution ducts be tested and verified by a HERS rater. A HERS rater must also verify the refrigerant charge and airflow across the evaporator coils. An alternative set of requirements offers an option which provides equivalent energy savings, but does not require diagnostic testing and field verification by a certified HERS rater. The alternative combination of features results in equal or less energy and it does not increase electric demand. This is achieved by requiring more energy efficient space conditioning equipment and fenestration. The Alternative to Package D requirements are shown in Table 1-3. All the other requirements of Package D must still be met.

**Table 1-3 –
Alternative to
Package D
(Alternative to
Duct Sealing and
TXV
Requirements)**

Climate Zone	Maximum Fenestration U-factor	Maximum Fenestration SHGC	Equipment Efficiency
1	0.55	--	90% AFUE
2	0.40	0.35	--
3	0.55	--	--
4	0.40	0.35	--
5	0.55	--	--
6	0.55	--	--
7	0.40	0.35	--
8	0.40	0.35	--
9	0.40	0.35	11 SEER
10	0.40	0.35	11 SEER
11	0.40	0.35	12 SEER
12	0.40	0.35	11 SEER
13	0.40	0.35	12 SEER
14	0.40	0.30	12 SEER
15	0.40	0.30	13 SEER
16	0.55	--	90% AFUE

Compliance Modeling Changes

Interior Shading Devices	There are several other changes that have an impact on the stringency of the <i>Standards</i> . Credit for interior shading is eliminated in all compliance approaches. Prior to the AB 970 changes, it was possible to comply with the solar shading requirements by installing opaque roller shades and/or blinds. In 1998, the interior shading credit was removed from the prescriptive compliance and the roller shade credit was reduced to a level equivalent to blinds. The AB 970 changes entirely eliminate the compliance credit for either roller shades or mini-blinds.
Central Air Conditioner Assumptions	The modeling assumptions for air conditioner system efficiency are changed to reflect typical performance, based on findings of field studies on standard practice airflow, refrigerant charge and fan wattage. The efficiency is also adjusted for outdoor temperature effects based on the typical operating temperatures found in California climate zones.

New Compliance Options

Cool Roofs	Cool roofs are a new compliance option added with the AB 970 changes. To qualify as a cool roof, the roof surface must have both a solar reflectance greater than 0.70 and a emissivity greater than 0.75. The solar reflectance criterion is 0.40 for clay and concrete tile roofs. The solar reflectance criterion applies to the initial reflectance of the manufactured product and does not account for aging. Manufacturer's literature or test reports can be used to verify cool roof products, but after January 1, 2003, all cool roof products qualifying for this credit are required to be tested and labeled according to procedures established by the Cool Roof Rating Council.
Multi-Family Ducts	The credit for ACCA Manual D duct design is expanded to multi-family buildings. This option was previously limited to single-family dwelling units. Note: The prescriptive requirements for duct sealing (maximum leakage of 6%) apply to multi-family buildings as well as single-family homes.

Mandatory and Procedural Changes

Fenestration Default Table	Labels used in the default fenestration U-factor tables are changed to more accurately reflect what is meant. In particular, the descriptors "uncoated" and "tinted" in <i>Standards</i>
---------------------------------------	--

Table 1-E are changed to “clear” and “tinted.” Actual values in the table remain unchanged.

<i>Duct Construction</i>	<p>The AB 970 changes also expand the mandatory measures for air distribution ducts.</p> <ul style="list-style-type: none">• Building cavities, support platforms for air handlers, and plenums defined or constructed with materials other than sealed sheet metal, duct board or flexible duct may not be used for conveying conditioned air including return air and supply air.• Such building cavities and support platforms may contain ducts, but ducts installed in cavities and support platforms shall not be compressed to cause reductions in the cross sectional area.• Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.
<i>Field Verification</i>	<p>The AB 970 changes give authority to the HERS rater for selecting a sample of homes for diagnostic testing. This will avoid delays in completing the necessary field verification and compliance documentation.</p>
<i>Multiple Orientation Alternative</i>	<p>Compliance with the energy standards is sensitive to orientation, especially in climates with significant cooling loads. If a tract home model complies in the four cardinal orientations (north, east, south and west), the <i>Standards</i> accept this as evidence that the home complies in any orientation. This multiple orientation option is offered as an exception to §151 (a) and (b).</p> <p>Prior to the AB 970 changes, a builder could modify solar shading for the house in different orientations in order to achieve compliance. Typically, exterior sunscreens or roller shades (when they were allowed as a compliance option) were added to the windows on the west and perhaps the south sides of the house. To the building inspector, each house would look a little different. Some would have sunscreens on the back of the house, if the back faced west. Some would have sunscreens on the front if the front faced west, etc.</p> <p>Advances in glazing technologies allow compliance with the low solar heat gain coefficients without the need for interior or exterior shading devices, so the AB 970 changes eliminate the option to relocate sunscreens or to modify shading by orientation. Tract homes that use the multiple orientation option must demonstrate compliance for the same set of features in each of the cardinal orientations. It is no longer possible to move shading devices from one orientation to another to achieve compliance.</p>
<i>Packages A, B and C Changes</i>	<p>Packages A and B are deleted as compliance options, since they are rarely used. To avoid confusion, Packages C and D are not renamed. The new and updated features of Package D are cost effective, and are included in Package C requirements as well. These requirements include the lower SHGC values for fenestration, duct diagnostic testing, and refrigerant charge and airflow testing (or TXV).</p>

1.3 Background

1.3.1 Legal Requirements – The Warren Alquist Act

All new buildings in California must meet the standards contained in Title 24, Part 6 of the California Code of Regulations. All new construction must comply with the *Standards* in effect on the date a building permit application is made (not when the building permit is issued).

Section 25402 of the Public Resources Code directs the California Energy Commission to:

“Prescribe, by regulation. . . building design and construction standards which increase the efficiency in the use of energy for new residential and new nonresidential buildings.

Applicable sections of California Code of Regulations Title 24, Part 1: 10-103.

“The standards shall be cost effective, when taken in their entirety, and when amortized over the economic life of the structure when compared with historical practice.”

Section 25402 also states that:

The commission shall periodically update the standards and adopt any revision which, in its judgment, it deems necessary. Six months after the commission certifies an energy conservation manual . . . , no city, county, city and county, or state agency shall issue a permit for any building unless the building satisfies the standards prescribed by the commission . . .

Changes to the *Standards* occur periodically to account for improvements in conservation technologies, changes in the cost of fuels and energy-conserving strategies, and improved capabilities in analyzing building energy performance. In addition, modifications are also made to further improve compliance and enforcement.

1.3.2 Benefits of Energy Conservation

This section discusses some of the underlying reasons why *Standards* are important and necessary for California’s energy future.

Energy Reliability and Demand

Buildings are one of the major contributors to electricity demand. With the 2000/2001 California energy crisis, the importance of conservation and efficiency is brought again to the forefront. The AB 970 changes will result in savings of over 800,000 therms/year of gas and about 100,000 MWh of electricity use. Perhaps more importantly, peak electricity demand is reduced by as much as 150 MW. Furthermore, these savings are cumulative, which means that they double in two years, triple in three, etc.

Comfort

Comfort is an important benefit of energy efficient houses. Energy efficient houses are well insulated, less drafty and use high performance windows and/or shading to reduce solar gains and heat loss. Poorly designed building envelopes result in houses that are less comfortable. Often comfort cannot be achieved in poorly designed houses, even with oversized heating and cooling systems.

Economics

For the homeowner, investing in building energy conservation helps to ensure that energy use in residences is affordable both now and into the future. Banks and other financial institutions recognize the impact of efficiency through energy efficient mortgages. From a larger perspective, the less California depends on depletable resources such as natural gas, coal and oil, the stronger and more stable the economy will remain in the face of energy cost increases. A Cost-effective investment in energy efficiency helps everyone.

Environment

In many parts of the world, the use of energy has led to oil spills, acid rain, smog and other forms of environmental pollution that have ruined the beauty people sought to enjoy. California is not immune to these problems, but the risks would be greater without appliance standards, building standards and utility programs that promote efficiency and conservation. Other benefits are reduced destruction of natural habitats, which in turn helps protect animals, plants and the natural systems.

Global Warming

Burning fossil fuel is a major contributor to global warming, as carbon dioxide is added to an atmosphere already containing 25% more than it did two centuries ago. Carbon dioxide and other gasses add an insulating layer to the earth that leads to global climate change. California Energy Commission (*Commission*) research shows that most of the sectors of the state economy face significant risk from climate change including water resources (from reduced snow pack), agriculture, forests and the natural habitats of a number of indigenous plants and animals.

Most scientists recommend that actions be taken to reduce emissions of carbon dioxide and other greenhouse gasses. While adding scrubbers to power plants and catalytic converters to cars is a step in the right direction, those actions do not limit the carbon dioxide we emit into the atmosphere. Using energy efficiently is a far-reaching strategy that can make an important contribution to the reduction of greenhouse gasses. The National Academy of Sciences urged the whole country to follow California's lead on such efforts, saying that we should make conservation and efficiency the chief element in energy policy. Their first efficiency recommendation was simple: Adopt nationwide energy efficient building codes. Energy conservation will not only increase comfort levels and save homeowners money; it will also play a vital role in creating and maintaining a healthy environment.

1.3.3 Which Standards Apply? Nonresidential vs. Residential

The California standards apply to both nonresidential and residential buildings. This *Manual* addresses the requirements for low-rise residential buildings. A companion manual addresses the requirements for nonresidential buildings, including hotels, motels, and residential buildings that are four stories or more in height.

Live-Work buildings are a special case, as they combine residential and nonresidential uses within individual units. Live-Work buildings are required to meet the applicable Low-rise or High-rise Residential Standards, due to the fact that these buildings operate (and therefore are conditioned) 24 hours per day. Lighting in designated workspaces is required to show compliance with the Nonresidential prescriptive lighting requirements (§146). Low-rise Residential Standards apply to live/work units that are part of a building with no more than three habitable stories. Note that the loft space in a unit with high ceilings is not counted as a separate story.

**Table 1-4 –
Building Types
Covered by the
Low-Rise
Residential and
Nonresidential
Standards**

Low-Rise Residential Standards	Nonresidential Standards
These standards cover all low-rise residential occupancies including single-family homes, duplexes, garden apartments and other housing types with less than three habitable stories.	These standards cover all nonresidential Uniform Building Code (UBC) occupancies (Group A, B, E, F, H, M or S), as well as high-rise residential (Groups R-1 and R-2 with four or more habitable stories), and all hotel and motel occupancies.
All single family dwellings of any number of stories (Group R-3)	Offices
All duplex (two-dwelling) buildings of any number of stories (Group R-3)	Retail and wholesale stores
All multi-family buildings with three or fewer habitable stories (Groups R-1 and R-2)	Grocery stores
Additions and alterations to all of the above buildings	Restaurants
	Assembly and conference areas
	Industrial work buildings
	Commercial or industrial storage
	Schools and churches
	Theaters
	Hotels and motels
	Apartment and multi-family buildings, and long-term care facilities (group R-2), with four or more habitable stories
The <i>Standards</i> define a habitable story as one that contains space in which humans may live or work in reasonable comfort, and that has at least 50% of its volume above grade.	
The Uniform Building Code (UBC) defines a “guest room” as “any room or rooms used or intended to be used by a guest for sleeping purposes. Every 100 square feet of superficial floor area in a dormitory shall be considered to be a guest room”. Therefore, congregate residences, or any building with dormitory-style sleeping quarters, with six or more “guest rooms” is considered a hotel/motel for purposes of <i>Standards</i> compliance (§101(b)). Hotels/motels, regardless of the number of stories, comply with the requirements found in the Nonresidential Manual.	

**Example 1-1 –
Historical
Buildings**

Question

When is an historical building exempt from the Energy Efficiency Standards (Title 24, Part 6)? Are additions to historical buildings also exempt?

Answer

A building is exempt from Part 6 when it is a “qualified historical building.” This term is defined in §8-302 of Title 24, Part 8 as a “structure or collection of structures, and their associated sites, deemed of importance to the history, architecture, or culture of an area by an appropriate local, state or federal governmental jurisdiction. This shall include designated structures on official existing or future national, state or local historical registers or official inventories, such as the National Register of Historic Places, State Historical Landmarks, State Points of Historical Interest, and officially adopted city or county registers or inventories of historical or architecturally significant sites, places or landmarks.”

“Additions which are structurally separated” from the historical building are not exempt from the Energy Efficiency Standards and must comply with current building codes (Historical Building Code, Title 24, Part 8, §8-504).

**Example 1-2 –
Mobile Homes**

Question

Do the standards in Title 24, Part 6, apply to an addition to a mobile home?

Answer

No. Title 25 requirements, not Title 24, govern mobile homes, including additions to the unit. Jurisdiction in a mobile home park comes under the authority of Housing and Community Development. Jurisdiction of a mobile home on private property may come under the authority of the local building department.

References to Part 6 of Title 24 mean the Energy Efficiency Standards, also called the Energy Code. References to Part 1 of Title 24 mean the Administrative Regulations, of which §10-101 through §10-113 pertain to Part 6. The Administrative Regulations contain information about the documentation requirements, procedural information and other administrative requirements.

1.4 Introduction to the Residential Standards

This section introduces the basic concepts and approaches for complying with the low-rise residential standards.

1.4.1 Compliance Approaches

There are two methods for complying with the residential energy *Standards*:

- **Prescriptive Packages** ("*Alternative Component Packages*"). The simplest approach in which each individual component of the proposed building must meet a prescribed minimum energy requirement.
- **Performance Methods** ("*Alternative Calculation Methods*"). Computer performance methods provide the most flexibility and accuracy in calculating energy use. Detailed accounting of energy *trade-offs* between measures is possible with the computer programs.

With either of these compliance paths, there are mandatory measures that still must be installed. Where superseded by a more stringent requirement to achieve compliance with the energy budget or prescriptive package, the more stringent feature becomes mandatory.

Note: The following buildings types are exempt from the prescriptive and performance standards.

- (a) Seasonally occupied agricultural housing limited by state or federal agency contract to occupancy not more than 180 days in any calendar year.
 - (b) Low-rise residential buildings that use no energy obtained from a depletable source for either lighting or water heating and obtain heat from wood heating or other non-mechanical system.
-

1.4.2 Mandatory Measures

The mandatory measures require minimum ceiling, wall and raised floor insulation; minimum HVAC (heating, ventilating and air conditioning) and water heating equipment efficiencies, and other requirements. The mandatory measures are required features with either the prescriptive or performance standards. For example a building may only need R-7 floor insulation to meet the performance standards, but R-19 must be installed because that is the mandatory minimum.

1.4.3 Prescriptive Packages

The prescriptive approach is the least flexible yet simplest compliance path. It is simple because an applicant need only show that a building meets each minimum or maximum level prescribed in the set of requirements contained in a package; few calculations, if any, are needed to demonstrate compliance. However, both packages C and D require

diagnostic testing of air distribution ducts, split system air conditioners and split system heat pumps.

Note: The Alternative to Package D allows use of higher performance fenestration, and sometimes, higher efficiency HVAC equipment in lieu of duct testing and installing TXVs.

Two prescriptive packages are designated for each climate zone by the letters C or D. Within any given package, every single feature must be met in order for the building to comply. Package D requirements form the basis of trade-offs using the performance method. There is also an Alternative to Package D that substitutes high efficiency equipment and high performance glazing (depending on climate zone) instead of duct sealing, TXVs or refrigerant charge and airflow measurement.

Package C has higher insulation levels, but permits electric resistance heat. Package C may only be used in areas where natural gas is not available."

The following compliance documentation showing that the building complies is required to be submitted with the prescriptive approach.

CF-1R	Certificate of Compliance (required)
MF-1R	Mandatory Measures Checklist (required)
Form 3R	Construction Assembly U-factor (if applicable)
Form 3RM	Masonry Wall Assembly (if applicable)
Form CF-4R	Field Verification and Diagnostic Testing (if applicable). This form is usually required when Package D or Package C is used since the package requires diagnostic testing of air distribution ducts, split system air conditioners and heat pumps.
Form S	Solar Heat Gain Coefficient Worksheet (if applicable)
DHW-1	Water Heating Calculations (if applicable)

Two additional forms, the Installation Certificate (CF-6R) and the Insulation Certificate (IC-1) are required during construction and must be posted or made available to the enforcement agency during building inspection. Refer to Chapter 3 for a complete discussion of prescriptive compliance. Refer to Chapter 7 for details on how the prescriptive approach is used with additions.

1.4.4 Performance Methods

The use of Energy Commission-approved *computer methods* represents the most detailed and sophisticated method of compliance. While this approach requires the most effort, it also provides the greatest flexibility. The computer program automatically calculates the *energy budget* for space conditioning. The budget is determined from the *standard design*, a version of the building, which is upgraded or downgraded to achieve minimum compliance with the prescriptive Package D conservation features.

The energy budget for space conditioning is expressed in thousands of Btu (kBtu) per square foot per year. The program also calculates the budget for water heating energy use in kBtu per dwelling unit (see Chapter 6). The water-heating budget is translated into a kBtu per square foot per year value and added to the space-conditioning budget to yield the combined energy budget. To comply with the *Standards*, the predicted combined "Energy Use" of the Proposed Design cannot exceed the combined "Energy Budget" of the Standard Design.

The following compliance documentation showing that the building complies is required to be submitted with the performance approach.

- CF-1R, Certificate of Compliance (required)
- MF-1R, Mandatory Measures Checklist (required)
- CF-2R, Computer Method Summary (required)
- Form 3R, Construction Assembly U-factor (if applicable)

The Installation Certificate (CF-6R) and Insulation Certificate (IC-1) are required during construction. Refer to Chapter 5 for a detailed explanation of compliance using approved computer methods. If features are used for compliance that require field verification and diagnostic testing a CF-4R, as detailed in Chapter 4, is required at the completion of construction.

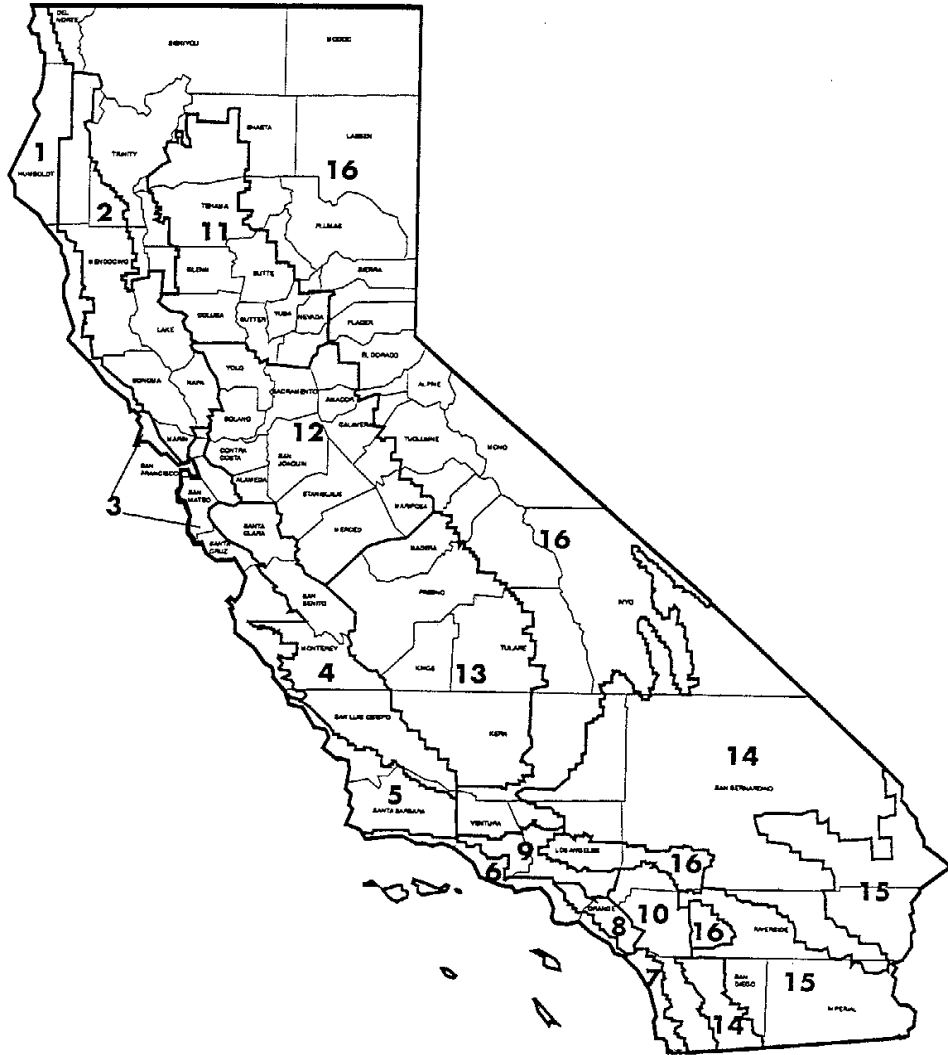
1.4.5 California Climate Zones

Energy use depends in part on climate conditions, which differ throughout the state. To standardize calculations and to provide a basis for presenting the criteria, the Energy Commission has established 16 climate zones, which are used with both the low-rise residential and the nonresidential standards. See the figure below.

Appendix D has a list of California cities showing the climate zone for each. More detailed climate zone boundary descriptions are available in the Energy Commission publication *California Climate Zone Descriptions for New Buildings*, July 1995, (P400-95-041).

Note: Cities may occasionally straddle two climate zones. In these instances, the exact building location and correct climate zone should be verified before any calculations are performed. If a single building development is split by a climate zone boundary line, it must be designed to the requirements of the climate zone in which 50% or more of the dwelling units are contained (see also Chapter 8).

Figure 1-1–
California Climate
Zones



1.4.6 Compliance and Enforcement Phases of the Building Process

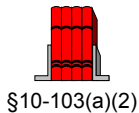
The goals set by any building standard are no better than the level of cooperation and communication among the parties involved in the building process. These parties may include some or all of the following: architect or designer, builder/developer, purchasing agent, general contractor, subcontractor/installer, energy consultant, plan checker, inspector, realtor and owner/first occupant. To help resolve potential energy compliance issues, the *Standards* specify detailed reporting requirements that are intended to provide design, construction, and enforcement parties with needed information to complete the building process and insure the energy features are installed. The above parties are accountable for ensuring that the building's energy features are installed in their phase of responsibility.

Design

This phase generally sets the stage for the type and style of building to be constructed. In addition to issues concerning zoning, lot orientation and infrastructure layout, the building's overall design and energy features are conveyed to working drawings of the building for construction. Parties associated with this phase must insure the energy features meet compliance with the *Standards* and that these features are detailed on the construction plans.

<i>Plan Check</i>	Local building departments check plans for conformance to building standards. This includes health and safety requirements, such as fire and structural, along with energy requirements. Vague and/or missing details on the construction plans must be changed or clarified by parties involved in the design phase of the building process.
<i>Construction</i>	Upon receiving a building permit from the local building department, parties associated with this phase construct the building according to the approved construction plans. It is not unusual for changes to be made "in the field". Field changes that may result in non-compliance require building department approval of revised plans and energy compliance documentation demonstrating that the building is still in compliance.
<i>Site Inspection</i>	Local building departments, or their representatives, inspect all new buildings to insure conformance to building standards. Field construction changes and non-complying energy features require parties associated with previous phases to repeat and revise their original efforts.
<i>Occupancy</i>	<p>The <i>Standards</i> require that the building owner at occupancy receive information indicated on forms:</p> <ul style="list-style-type: none"> • Certificate of Compliance (CF-1R) • Mandatory Measures Checklist (MF-1R) • Installation Certificate (CF-6R) • Insulation Certificate (IC-1) <p>They must also receive either:</p> <ul style="list-style-type: none"> • A manual which contains instructions for operating and maintaining the features of their building efficiently, or • <i>The Guide to California Home Comfort and Energy Savings</i> (P400-99-031). <p>For individually owned units in a multi-family building the documentation is provided to the owner of the dwelling unit or to the individual(s) responsible for operating the feature, equipment or device. The maintenance information is provided to whomever is responsible for maintaining the feature, equipment or device. Information must be for the appropriate dwelling unit or building (photocopies are acceptable).</p>

1.4.7 How to Comply with the Standards



- B. *Plans and specifications submitted with each application for a building permit shall show the characteristics of each feature, material, component, and manufactured device proposed to be installed in order to have the building meet the requirements of Part 6, and of any other feature, material, component, or manufactured device that Part 6 requires be indicated on the plans and specifications. If any characteristic is materially changed before final construction and installation, such that the building may no longer comply with Part 6, the building must be brought back into compliance, and so indicated on amended plans, specifications, and Certificate(s) of Compliance and shall be submitted to the enforcement agency. Such characteristics shall include the efficiency (or other characteristic regulated by Part 6) of each device.*
- C. *All documentation necessary to demonstrate compliance for the building, and of the sections of Part 6 with which the building is intended to comply shall be submitted with each application for a building permit. The forms used to demonstrate compliance shall be readily legible and of substantially similar format and informational order and content to the appropriate forms in the Residential or Nonresidential Manual, as defined in Part 6.*



Title 24, Part 6 contains the Energy Efficiency Standards. Part 1 contains administrative, documentation, and procedural requirements for complying with the *Standards*.

To comply with the Residential Standards, the permit applicant follows these general steps:

- Verify that the Low-rise Residential Standards apply and that the correct climate zone is used for the building location.
- Demonstrate that the building meets the *Standards* with one of the two compliance options: prescriptive packages or approved performance method.
- Include all appropriate mandatory features and provisions applicable to the building design.
- Document and coordinate all calculations, plans and specifications. This includes completing a *Certificate of Compliance (CF-1R)* that must appear on the drawings. See below for additional information on the CF-1R.
- Install all specified measures in the building. The person responsible for construction or the installer of equipment must either post the installation certificate (Form CF-6R) or keep it with the plans and make it available to the inspector. This form, or several forms that together contain all the required information, must identify and provide the relevant energy efficiency data for each HVAC system, water heater system, fenestration product, faucet and showerhead, and any other manufactured device regulated by the *Standards*.

In addition, an Insulation Certificate (IC-1) must also either be posted by the insulation installer in a conspicuous location or kept with the plans and made available to the inspector.

- For new dwelling units, deliver a copy of *The Guide to California Home Comfort and Energy Savings* or an equivalent document to the building owner at the time of occupancy along with copies of the CF-1R, MF-1R, CF-6R and IC-1. See below for additional information about *The Guide to California Home Comfort and Energy Savings* (formerly the Home Energy Manual).

The enforcement agency may require the person with overall responsibility for the construction to provide any other reasonable information to determine that the building, as constructed, is consistent with approved plans and specifications.

Example 1-3 – Form CF-6R

Question

What is a CF-6R and why is it required?

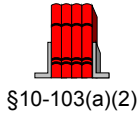
Answer

The CF-6R is an installation certificate for manufactured devices regulated by the appliance standards (see Part 6 of Title 24, §111) and a certification of installer tests for duct efficiency and reduced envelope leakage credits. The certification must include a statement indicating that installed devices conform to appliance and building standards and to any additional requirements contained in the plans and specifications. The certificate must be signed by the person with overall responsibility for construction or the person(s) responsible for installing the certified devices and/or appliances. This certificate must either be posted adjacent to the building permit or made available to the inspector during construction.

Information required on the CF-6R such as manufacturer, model number and efficiency helps to ensure that installed devices conform to specifications on the CF-1R and meet or exceed minimum efficiency requirements. It also serves to advise the homeowner what devices were installed in their home.

1.4.8 Compliance Documentation

Certificate of Compliance (CF-1R)



- A. *For all new buildings designated to allow a conditioned use of an occupancy group or type regulated by Part 6 the applicant shall file the appropriate Certificate(s) of Compliance on the plans. The Certificate(s) shall indicate the features and performance specifications needed to comply with Part 6, and shall be approved by the local enforcement agency by stamp or authorized signature. The Certificate(s) of Compliance and supporting documentation shall be readily legible and of substantially similar format and informational order and content to the appropriate Certificate(s) of Compliance and supporting documentation in the appropriate Residential or Nonresidential Manual, as defined in Part 6.*



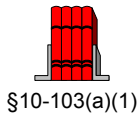
All building permit applicants shall file a certificate of compliance on the plans as required by Title 24, Part 1, §10-103(a) 2 A of the Code of Regulations.

The items listed in the CF-1R form represent a set of minimum energy performance specifications, including the results of the heating load calculation. While a performance method analysis may be used to show compliance on a particular combination of conservation measures, the building must be constructed to meet or exceed the performance level established by all of the features and specifications contained in the CF-1R.

Placing a transparency of the CF-1R on the drawings, taping a CF-1R to the drawings or printing the CF-1R information directly on the drawings may meet the requirement that the certificate be on the plans. Verify with the local enforcement agency, which is acceptable.

A blank copy of the recommended CF-1R form is contained in Appendix A. The same information is submitted regardless of the compliance approach. A completed example of the CF-1R form is in Chapter 5.

Responsibility for Signing the CF-1R



The Certificate(s) of Compliance described in §10-103 shall be signed by the person(s) responsible for the building design to certify conformance with Part 6. The signer(s) shall be eligible under Division 3 of the Business and Professions Code to sign such documents. If more than one person has responsibility for building design, each person may sign the document or documents applicable to that portion of the design for which the person is responsible. Alternatively, the person with chief responsibility for design may prepare and sign the document for the entire design.

Subject to the preceding paragraph, persons who prepare energy compliance documentation shall sign a statement that the documentation is accurate and complete.



The signature on the Certificate of Compliance of the “Designer” is the person who takes responsibility for the building design being in compliance with the *Standards*. This person must have the authority given by the *Business and Professions Code* for the type of construction.

Note: The documentation author is not subject to the limitations and restrictions of the *Business and Professions Code*. The documentation author’s signature is to verify that the documentation is accurate and complete.

Business and Professions Code

If the building type requires that a licensed individual take responsibility for design under the *Business and Professions Code*, then that individual must sign as the designer and lists his or her license number above the signature. When the building type does not require the signature of a licensed individual, another individual may take responsibility as designer.

The person who signs as the designer certifies that he or she has either:

- Directly prepared and coordinated the compliance documents; or
- Delegated responsibility to an energy documentation author who has provided the compliance analysis and documentation under their direction.

The documentation author also signs the CF-1R to indicate their responsibility for the accuracy and completeness of the compliance documentation.

Section 5537(a) and 6737.1 of the *Business and Professions Code* specifically exclude the following building types from requiring a licensed architect and engineer to design the building:

“5537 [and 6737.1]. (a) This chapter does not prohibit any person from preparing plans, drawings, or specifications for any of the following:

“(1) Single-family dwellings of woodframe construction not more than two stories and basement in height.

“(2) Multiple dwellings containing no more than four dwelling units of woodframe construction not more than two stories and basement in height. However, this paragraph shall not be construed as allowing an unlicensed person to design multiple clusters of up to four dwelling units each to form apartment or condominium complexes where the total exceeds four units on any lawfully divided lot.”

“(3) Garages or other structures appurtenant to buildings described under subdivision (a), of woodframe construction not more than two stories and basement in height.”

“(4) Agricultural and ranch buildings of woodframe construction, unless the building official having jurisdiction deems that an undue risk to the public health, safety, or welfare is involved.”

“(b) If any portion of any structure exempted by this section deviates from substantial compliance with conventional framing requirements for woodframe construction found in the most recent edition of Title 24 of the California Code of Regulations or tables of limitation for woodframe construction, as defined by the applicable building code duly adopted by the local jurisdiction or the state, the building official having jurisdiction shall require the preparation of plans, drawings, specifications, or calculations for that portion by, or under the responsible control of, a licensed architect or registered engineer. The documents for that portion shall bear the stamp and signature of the licensee who is responsible for their preparation. Substantial compliance for purposes of this section is not intended to restrict the ability of the building officials to approve plans pursuant to existing law and is only intended to clarify the intent of Chapter 405 of the Statutes of 1985.”

Mandatory Measures Checklist: Residential (MF-1R)



The Mandatory Measures Checklist for Residential Buildings is provided as a convenient summary of the mandatory measures required for low-rise residential buildings.

The items listed on the MF-1R form represent minimum component performance specifications that must be installed at or above the efficiency levels specified. In some cases, a specific compliance approach has requirements that supercede and go beyond the mandatory measure requirements. For example, Package D requires R-30 ceiling insulation that is more than the mandatory measure minimum of R-19. While the performance approach allows the *Standards* to be met with more flexibility, the mandatory measures must always be met or exceeded regardless of the compliance approach.

Field Verification and Diagnostic Testing Certificate (CF-4R)

When compliance documentation requires field verification and/or diagnostic testing of specific energy efficiency improvements as a condition for those improvements to qualify for Title 24 compliance credit, an approved HERS provider and certified rater must be used to conduct the field verification and diagnostic testing.

The HERS rater providing the diagnostic testing and verification shall sign and date a *Certificate of Field Verification and Diagnostic Testing* (CF-4R) certifying that they have verified that the requirements for compliance credit have been met. The HERS rater shall provide this certificate to the builder and the HERS provider. Raters shall provide a separate *Certificate of Field Verification and Diagnostic Testing* for each house the rater determines has met the diagnostic requirements for compliance. The HERS rater shall not sign a *Certificate of Field Verification and Diagnostic Testing* for a house that does not have a CF-6R signed by the installer.

Installation and Insulation Certificates (CF-6R and IC-1)



The *Standards* require that the CF-6R be signed by the installer of each device (heating, cooling, water heating/plumbing equipment, heating and cooling distribution systems, air infiltration reduction systems, and fenestration products) or alternatively, the person with chief responsibility for construction.

The insulation installer must sign the IC-1.

Persons signing these forms are verifying that the installed efficiencies meet or exceed those used for compliance with the *Standards* as shown on the CF-1R.

(3) Installation Certificate.

- (A) *The person with overall responsibility for construction or the person or persons responsible for the installation of regulated manufactured devices shall post, or make available with the building permit(s) issued for the building, the installation certificate(s) for manufactured devices regulated by the appliance standards or Part 6. Such installation certificate(s) shall be made available to the enforcement agency for all appropriate inspections.*

These certificates shall:

1. *Identify features required to verify compliance with the appliance standards and Part 6.*
 2. *Include a statement indicating that the installed devices conform to the appliance standards and Part 6 and the requirements for such devices given in the plans and specifications approved by the local enforcement agency.*
 3. *State the number of the building permit under which the construction or installation was performed.*
 4. *Be signed by the individual eligible under Division 3 of the Business and Professions Code to accept responsibility for construction, or their authorized representative. If more than one person has responsibility for building construction, each person may prepare and sign the part of the document applicable to the portion of construction for which they are responsible; alternatively, the person with chief responsibility for construction may prepare and sign the document for the entire construction).*
- (B) *The enforcement agency may require the person with overall responsibility for the construction to provide any other reasonable information to determine that the building as constructed is consistent with approved plans and specifications and complies with Part 6.*



§10-103(a) (3) and (4)

- (C) *If construction on any portion of the building subject to Part 6 will be impossible to inspect because of subsequent construction, the enforcement agency may require the installation certificate(s) to be posted upon completion of that portion.*

(4) *Insulation Certificate.*

After installing wall, ceiling, or floor insulation, the installer shall make available to the enforcement agency or post in a conspicuous location in the building a certificate signed by the installer stating that the installation is consistent with the plans and specifications described in Section 10-103(a)2.A and for which the building permit was issued and conforms with the requirements of Part 6. The certificate shall also state the manufacturer's name and material identification, the installed R-value, and (in applications of loose fill insulation) the minimum installed weight per square foot consistent with the manufacturer's labeled installed design density for the desired R-value.

The IC-1 must be posted at the job site in a conspicuous location (e.g., in the garage) or kept with the building permit and made available to the enforcement agency. The IC-1 must document the actual value of the installed insulation. Both forms must be provided to the building owner at occupancy.

The Installation Certificate (CF-6R) and Insulation Certificate (IC-1) are required to be posted at the job site or made available with the building permit during the construction phase of the project. The CF-6R is used to document all equipment and fenestration products installed in the building and installer test results for duct efficiency and reduced infiltration measures. The installer is responsible for verifying and complying with the efficiencies used to achieve compliance, as indicated on the CF-1R. These efficiencies (such as AFUE or HSPF for heating equipment, SEER for cooling equipment, energy factor for water heating, and U-factor for fenestration products) must meet or exceed each value shown on the CF-1R. This means that the AFUE, HSPF, SEER or EF must be greater than or equal to the CF-1R value and the U-factor and SHGC must be equal to or less than the CF-1R value.

Note: In a cold climate where heating loads significantly dominate cooling loads, a lower SHGC may be worse for the overall energy efficient operation of the home.

*Example 1-4 –
Plan Checking/
Field Inspection
Requirements*

Question

What are the plan checking/field inspection requirements related to the CF-6R?

Answer

The CF-6R (Installation Certificate) is not required to be submitted with other compliance documentation at the time of permit application, but rather is posted or made available for field inspection. A field inspector will want to check the equipment installed against what is listed on the CF-6R and compare the CF-6R and CF-1R for consistent equipment characteristics.

For a performance approach that relies on duct efficiency improvements or reduced envelope leakage, the field inspector should check the Special Features and Modeling Assumptions and HERS Required Verification listings on the CF-1R for required installer tests for reduced duct leakage or building pressurization and verify that these tests were performed and documented on the Installation Certificate CF-6R.

California Code of Regulations §10-103(a)(3)(B) allows the enforcement agency to request additional information to determine that the building is constructed consistent with approved plans and specifications. When equipment efficiencies above the minimum requirements are shown on the CF-1R (e.g., 12 SEER cooling equipment; 0.63 energy factor water heater), the building department should have procedures in place to verify efficiency. Requiring proof of efficiency from the installer, such as a copy of the appropriate page from a directory of certified equipment, is one possibility. Another

possibility is to require that the applicant send a duplicate of the CF-6R through plan check for verification.

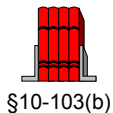
Question

What happens to the CF-6R after the final inspection?

Answer

California Code of Regulations §10-103(b) requires that the builder provide to the "building owner, manager, and the original occupants the appropriate Certificate(s) of Compliance and a list of the features, materials, components, and mechanical devices installed in the building, and instructions on how to use them efficiently" (italics added). At a minimum, information on the CF-6R and CF-1R must be provided to the original building occupants as well as operating and maintenance information such as the "The Guide to California Home Comfort and Energy Savings" (CEC publication number P400-99-003-FXX, where the XX are numbers that relate to a series of subject matter inserts that can be placed in the guide).

1.4.9 The Guide to California Home Comfort and Energy Savings



Operating and Maintenance Information to be Provided by Builder.

- (1) *Operating Information. The builder shall provide the building owner at occupancy the appropriate Certificate(s) of Compliance and a list of the features, materials, components, and mechanical devices installed in the building and instructions on how to operate them efficiently. The instructions shall be consistent with specifications set forth by the Executive Director.*

For residential buildings, such information shall, at a minimum, include information indicated on forms Certificate of Compliance (CF-1R), Mandatory Measures (MF-1R), Installation Certificate (CF-6R), Insulation Certificate (IC-1), and a manual which provides all information specified in this Section 10-103(b). The Home Energy Manual (P400-92-031) may be used to meet the requirement for providing this manual.

For dwelling units, buildings or tenant spaces which are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for operating the feature, material, component or mechanical device installed in the building.

- (2) *Maintenance Information. The builder shall provide to the building owner at occupancy maintenance information for all features, materials, components, and manufactured devices that require routine maintenance for efficient operation. Required routine maintenance actions shall be clearly stated and incorporated on a readily accessible label. The label may be limited to identifying, by title and/or publication number, the operation and maintenance manual for that particular model and type of feature, material, component, or manufactured device.*

For dwelling units, buildings or tenant spaces which are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for maintaining the feature, material, component, or mechanical device installed in the building.



The Energy Commission has prepared *The Guide to California Home Comfort and Energy Savings* (P400-99-003) as a replacement for the *Home Energy Manual*. Copies of the *Guide* can be obtained by contacting the *Energy Standards Hotline* at (800) 772-3300. The guide provides information to the homeowner regarding energy saving

features and energy efficient operation and maintenance of their home. This is an example of the type of guide or manual that must be provided to fulfill the requirements of the standards. The Energy Commission's *The Guide to California Home Comfort and Energy Savings* may be used to meet these requirements or can be used as a sample for builders to develop their own guide that meets the requirements.

The owner of the residence when it is first occupied must receive *The Guide to California Home Comfort and Energy Savings* or, at the builder's option, a manual which otherwise provides all information specified in §10-103(b). Copies of the CF-1R, MF-1R, CF-6R, and IC-1 compliance forms must be included with either the *Guide* or the builder's manual.

In multi-family buildings or where central systems provide space conditioning or water heating, the information is provided to whoever is responsible for operating and maintaining the building or equipment.

**Example 1-5 –
Administrative
Regulations**

Question

As a general contractor, when I have finished building a residence, is there a list of materials I am supposed to give to the building owner?

Answer

The "owner at occupancy" must receive a copy of the following completed forms for that dwelling unit:

- Certificate of Compliance (CF-1R)
- Mandatory Measures Checklist (MF-1R)
- Installation Certificate (CF-6R)
- Insulation Certificate (IC-1)

In addition, they must receive either:

- A manual which contains instructions for operating and maintaining the features of their building efficiently, or
- *The Guide to California Home Comfort and Energy Savings* published by the Energy Commission.

Question

I built some multi-family buildings and have some questions about the information I must provide (as required by Administrative Regulations, §10-103). Specifically:

If the building is a condominium, can I photocopy the same information for all units?

When the building is an apartment complex (not individually owned units), who gets the documentation?

If an apartment is converted to condominiums, does each owner/ occupant receive copies of the documentation?

Answer

Photocopied information is acceptable. It must be obvious that the documentation applies to that dwelling unit—that is, the features installed must match the features shown on the Installation Certificate. If compliance documentation is for a "building," a photocopy of the compliance forms for that building must be provided. If individual compliance is shown for each unique dwelling unit, a photocopy of the documentation, which applies to that dwelling unit, must be provided.

The documentation and operating information is provided to whomever is responsible for operating the feature, equipment or device (typically the occupant). Maintenance information is provided to whomever is responsible for maintaining the feature, equipment or device. This is either the owner or a building manager. (§10-103(b) (1)-(2).)

If, during construction, the building changes from an apartment to condominiums, each owner at occupancy would receive the documentation. If an existing apartment building changes to condominiums at a later date, the documentation requirements are triggered only by a building permit application requiring compliance with the Energy Efficiency Standards. (Changing occupancy does not trigger compliance with the *Standards*.)

Question

What is my responsibility with respect to the CF-6R (Installation Certificate) (a) as an inspector and (b) as a builder?

Answer

The building inspector is responsible for checking the CF-6R at appropriate inspections to be sure it is filled out and signed for the completed work. Inspectors can verify that the installed features are “consistent with approved plans,” as indicated on the Certificate of Compliance (CF-1R) form. Since the CF-6R may be posted at the job site or kept with the building permit, the inspector can request that this form be made available for each appropriate inspection. It is not advisable to wait until the final inspection to check the CF-6R (§10-103(d)(2)).

The general contractor, or his/her agent (such as the installing contractor), takes responsibility for completing and signing the form for the work performed. (A homeowner acting as the general contractor for a project may sign the CF-6R.) The compliance statement for their signature indicates that the equipment or feature: is what was installed; is equivalent or more efficient than required by the approved plans (as indicated on the CF-1R); and meets any certification or performance requirements (§10-103(a)(3)(A)).

1.5 Code Decisions: Case Studies

The first step in any project is to establish which standards apply and which compliance requirements must be met. Once that is done, compliance options can be considered and appropriate documentation prepared (or, in the case of enforcement, forms reviewed and data verified).

Be sure that basic code decisions are correct; otherwise a considerable waste of effort may be expended attempting to meet the standards using an incorrect compliance approach. If in doubt, verify fundamental assumptions about the applicability of the standards for a specific project with the local enforcement agency before performing calculations to demonstrate compliance. The Energy Commission Energy Hotline is also available for assistance as explained in Section 1.6.

The following examples present several residential building scenarios and explain each in the context of which standards, if any, apply.

**Example 1-6 –
Code Decisions
Scenarios**

Question

A sunspace addition is designed with no mechanical heating or cooling and a glass sliding door separating it from all existing conditioned space. Under what conditions will the *Standards* not apply to this addition?

Answer

The *Standards* do not apply if the space is unconditioned (see Appendix G *Glossary*). This is the case if:

- The new space is not provided with heating or cooling (or supply ducts);
- The new space can be closed off from the existing house with weather-stripped doors; and,
- The addition is not indirectly conditioned space (see Appendix G *Glossary*).

Question

Three stories of residential dwelling units are planned over a first story that includes retail and restaurant occupancies. Should the residential apartments comply with the Residential Standards?

Answer

No. The residential apartments must comply with the Nonresidential (High-rise Residential) Standards since the structure contains four habitable stories and, as a whole structure, is a high-rise building. See Mixed Occupancy Buildings in Section 8.2 to determine whether all four stories can be treated as the dominant occupancy.

Question

A four-story single-family townhouse has been constructed. Should the townhouse comply with the Residential Standards?

Answer

Yes. As a group R-3 occupancy, the Residential Standards apply. The building is not an apartment house (which, according to the UBC, must be at least three dwelling units).

Question

A 1200 ft² manager's residence is being constructed as part of a new conditioned warehouse building with 14,000 ft². Which standards apply?

Answer

The whole building can comply with the Nonresidential Standards, and the residential unit is not required to comply separately since it is a subordinate occupancy containing less than 10% of the total conditioned floor area (see Section 8.2). However, the residential dwelling unit must meet all low-rise residential mandatory measures (see Chapter 2).

Question

Assume the same scenario as in the previous example, except that the dwelling unit is new and the remainder of the building is existing. Do the Residential Standards apply?

Answer

Yes. Since 100% of the addition being permitted is a low-rise residential occupancy, compliance under the Residential Standards is required (see Chapter 7).

Question

An existing duplex is remodeled without increasing the amount of conditioned space. Do the Residential Standards apply?

Answer

Even though no new conditioned space is being created, the remodel must comply with applicable mandatory measures of the Residential Standards. See Section 7.5.

Question

An existing house is remodeled without increasing conditioned space. New windows are replacing old ones, and a new window is being added. Several exterior walls are being opened up in order to install new wiring. What requirements will apply?

Answer

The new window that is being added must have a maximum U-factor of 0.75 and must meet the SHGC requirements of Package D. The other windows that are being replaced do not have to meet U-factor or SHGC requirements. The house must also comply with the mandatory measures applicable to the windows and wall insulation described in Chapter 2.

Question

A 95 ft² family room is being added to an existing 2800 ft² house. What are the applicable compliance requirements?

Answer

The addition alone must comply with the Residential Standards or the existing-plus-addition must comply as explained in Section 7.1. If the prescriptive compliance approach is used for the addition alone, special prescriptive requirements apply (see Chapter 7, Table 7-1).

Question

A residence is being moved to a different location. What are the applicable compliance requirements?

Answer

Since this is an existing conditioned space, the requirements applicable to alterations would apply to any alterations being made (Chapter 7). The building does not need to show compliance with the current energy standards applicable to new buildings or additions.

Question

A previously conditioned retail space is remodeled to become a residential dwelling. What are the applicable compliance requirements?

Answer

The residential dwelling is treated as if it were previously a residential occupancy. In this case, the rules that apply to residential alterations (Chapter 7) are applied.

Question

A 10,000 ft², 16-unit motel is constructed with an attached 950 ft² manager's residence. What are the applicable compliance requirements?

Answer

The manager's unit is less than 10% of the total floor area, so compliance of the whole building as the predominant motel occupancy would satisfy the requirements of the standards (see Section 8.2). Either the entire building must comply with the Nonresidential (High-Rise Residential and Hotel/Motel) Standards; or the manager's residence must comply with the low-rise Residential Standards and the motel occupancy portion of the building must comply with the Nonresidential Standards.

Question

A subdivision of detached homes includes several unit types, each of which may be constructed in any orientation. What are the applicable compliance requirements?

Answer

The low-rise Residential Standards are applied to each building type. All four cardinal orientations may be shown to comply or each individual unit in its planned orientation must comply (see Section 8.3).

Question

A four-story apartment building has three stories of apartments and a garage on the first floor. What are the applicable compliance requirements?

Answer

For standards compliance, the Low-rise Residential Standards apply since the building has fewer than four habitable stories.

Note: The UBC considers this a four-story building. As a high-rise building for compliance with other building codes, different health and safety regulations apply.

1.6 Where To Get Help

If the information contained in the standards or this *Manual* is not sufficient to answer a specific question concerning compliance or enforcement, technical assistance is available from the Energy Commission's Energy Hotline, weekdays from 8 a.m. - noon and 1 p.m. - 4 p.m.:

(800) 772-3300

(916) 654-5106

1.6.1 Publications

Publications may be ordered from:

*Publications Unit
California Energy Commission
1516 Ninth Street, MS-13
Sacramento, CA 95814
(916) 654-5200 (no phone orders)*

Appendix E contains a list of available publications.

The CEC publishes the *Blueprint*, a quarterly newsletter that answers questions related to enforcement and compliance that are not covered in the standards, provides updated information on technical assistance and computer compliance programs, and lists training opportunities offered throughout the state. The *Blueprint* is available at the CEC website at <http://www.energy.ca.gov/title24>.

Forms and pages of publications can be faxed by an automated system at any time. This system is available by calling (916) 653-6830. You must enter a document number (a list of documents and document numbers is available on the system) and your fax number.

1.6.2 Appliance Certification Information

Any directory that has been approved by the Commission can be used for determining if appliances meet the standards. The Energy Hotline (see above) can verify certification of appliances and provide information on appropriate directories.

The *Commission's* web site now includes references to listings of the most energy efficient appliances for several appliance types. The web site address is: <http://www.energy.ca.gov/efficiency/appliances/index.html>.

The complete appliance databases can be downloaded from the *Commission's* internet web site at <http://www.energy.ca.gov/appliances/appliance/>. This requires database software (spreadsheet programs cannot handle some of the larger files). To use the data, a user must download the database file (or files), download a brand file and a manufacturer file and then decompress these files. The user must then download a description file that provides details on what is contained in each of the data fields. With the help of these files and database software, the data can be sorted and manipulated.

1.6.3 Insulation Certification

Manufacturers whose insulating materials are certified for sale in California are listed in the Department of Consumer Affairs' *Consumer Guide and Directory of Certified Insulation Material*. Each building department receives a copy of this directory. If an insulating product is not listed in the directory, or to purchase a directory, contact the Department of Consumer Affairs, Thermal Insulation Program, at (916) 574-2065.

1.6.4 Training Opportunities

If you are interested in attending a training seminar on the Residential Standards:

- Sign up to receive a free subscription to the *Blueprint*, a quarterly newsletter that answers questions on the standards not covered elsewhere, updated information on technical assistance and computer compliance programs, and lists training opportunities offered throughout the state. An order form is provided at the front of this *Manual*. Blueprints can also be downloaded in electronic form from www.energy.ca.gov/title24.
- Some colleges provide classes on building energy conservation and the energy standards. Information about these classes should be obtained directly from the college.
- Energy consulting firms, organizations of energy consultants, building industry and trade associations, and organizations that serve building officials will often sponsor or conduct classes on compliance and enforcement of the Title 24 building energy efficiency standards. These classes are often listed in the *Blueprint* or posted on the Commission's website at <http://www.energy.ca.gov/title24>.